NASA SP-73

THE NATURE AND SCOPE OF THE NASA UNIVERSITY PROGRAM

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THE NATURE AND SCOPE OF THE NASA UNIVERSITY PROGRAM

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Scientific and Technical Information Division 1965
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
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THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, as did its predecessor agency, the National Advisory Committee for Aeronautics, recognizes the importance of a close working relationship with the educational community. Four university conferences attended by members of the NASA staff and university representatives have now been held to encourage exchange of views. The first two were aimed primarily at the rapid dissemination of scientific information that was becoming generally available through declassification as a result of cessation of hostilities, first World War II and then the Korean Conflict. In 1962, the first University Conference under NASA sponsorship was held in Chicago for the purpose of presenting to the educational community NASA's views on the problems confronting it and the avenues of investigation that it hoped university personnel

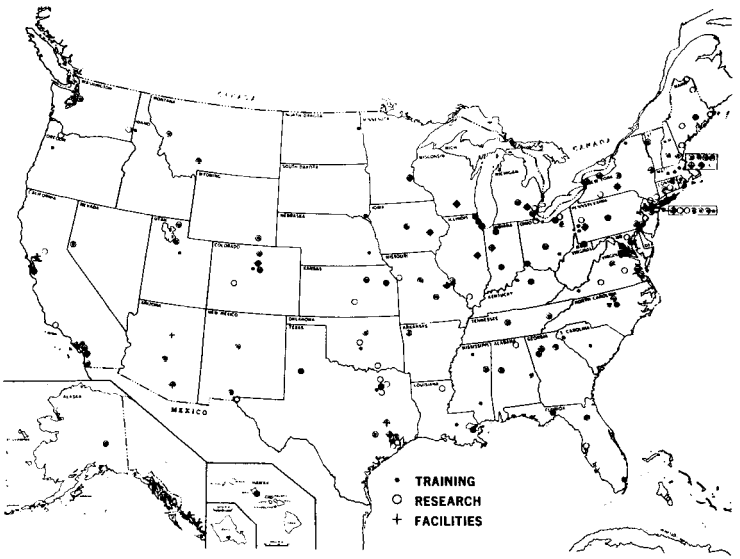

FIGURE 1—Locations of participants in NASA University Program. January 1, 1965.

would pursue in helping to further the national space program. Since that time NASA's university activities have grown at a rapid rate and at present nearly 200 universities are participating in one or more of the types of activity that comprise the NASA University Program. (See fig. 1.) In early 1965 another university conference was organized in order to permit the universities to report on their activities, not only to NASA but to the other universities that are either working in similar areas or are interested in being kept abreast of activities in the space program. The purpose of this conference was to discuss the

nature of work being undertaken, the manner in which it was being conducted, the results being obtained, and, where appropriate, to comment on the impact of the program.

From its beginning in 1958, NASA has recognized that doing business with nonprofit scientific and educational institutions is a specialized activity and has maintained within its organizational structure a group intended to serve as the focal point for NASA's relationships with these organizations. This is the Office of Grants and Research Contracts. This office is responsible for establishing policies and procedures for NASA's dealings with these institutions and for administering those segments of the university program that emanate from NASA Headquarters. Although organizationally located within the Office of Space Science and Applications, its responsibilities are agencywide. Thus it serves all of NASA, including the Office of Advanced Research and Technology and the Office of Manned Space Flight, in administering those phases of programmatic activities that are carried on in nonprofit scientific and educational institutions.

The present organization chart of NASA is shown in figure 2. A picture of the NASA organization as it may best be viewed from the university viewpoint is presented in figure 3—in which emphasis is placed on the role of the Office of Grants and Research Contracts and the manner in which it is operated within the NASA organization.

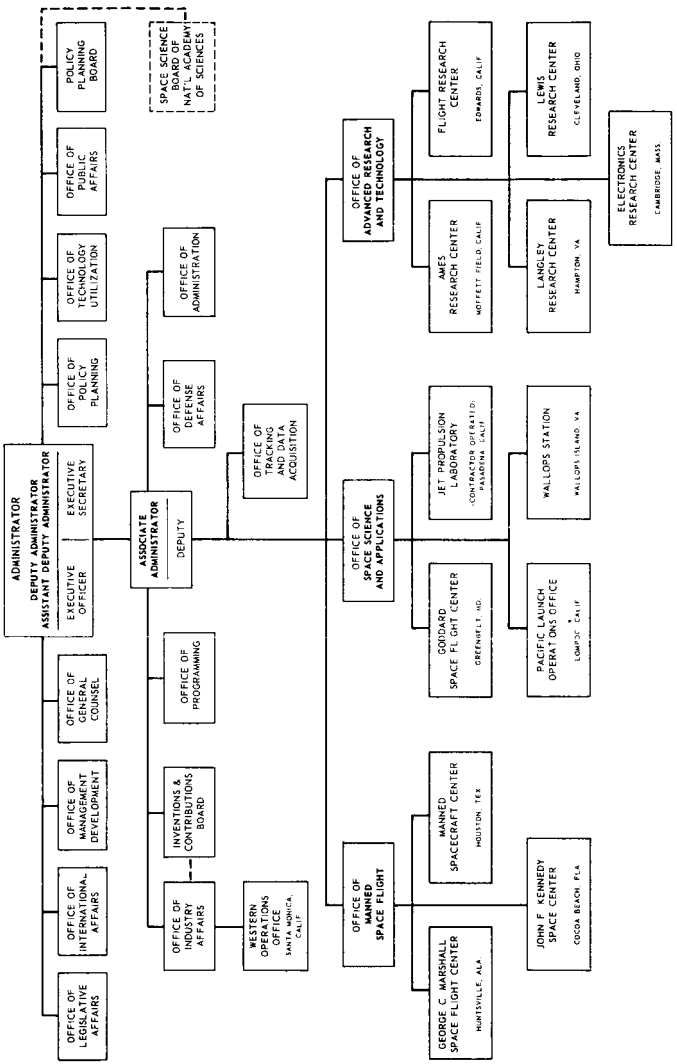

FIGURE 2—Organization of the National Aeronautics and Space Administration.

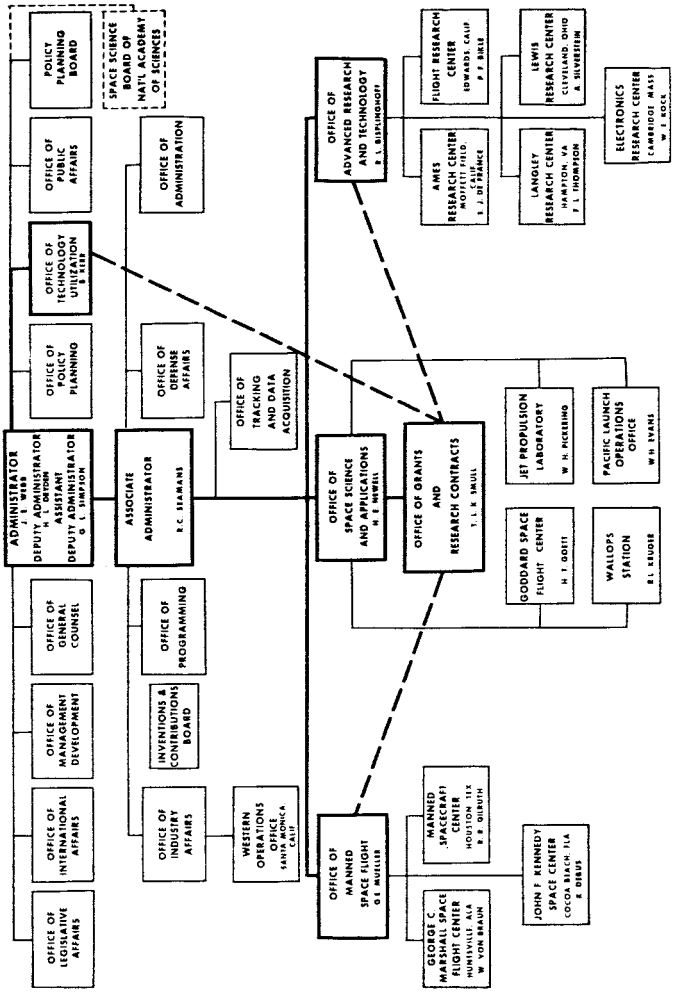

FIGURE 3—University view of the National Aeronautics and Space Administration.

In the early days of NASA its university program consisted of what has generally been termed project research. Proposals submitted to NASA for studies that were considered to be of interest to the space program were evaluated and those that were considered to be either an integral part of or in direct support of rather specific requirements of on-going NASA programs were sponsored within the limits of the funding that was available.

In 1961, when the landing of an American on the Moon in this decade was defined as a national goal, NASA undertook an intensive review of the scope of its university activities. It was evident from these studies that if NASA were to keep pace with the accelerated program that was set forth, it was essential that additional steps be taken to enchance the participation of the educational community in the space program. As a result, the Sustaining University Program was initiated. The growth of the university involvement in the NASA program is shown in figure 4. The funds obligated to universities have grown from a little over $3 million in Fiscal Year 1959 to nearly $110 million in Fiscal Year 1964. It is anticipated that NASA's annual obligations to universities will continue to grow during the next few years, but at a substantially reduced rate over that shown in this figure. For Fiscal Year 1965, it was estimated that the total would approximate $125 million.

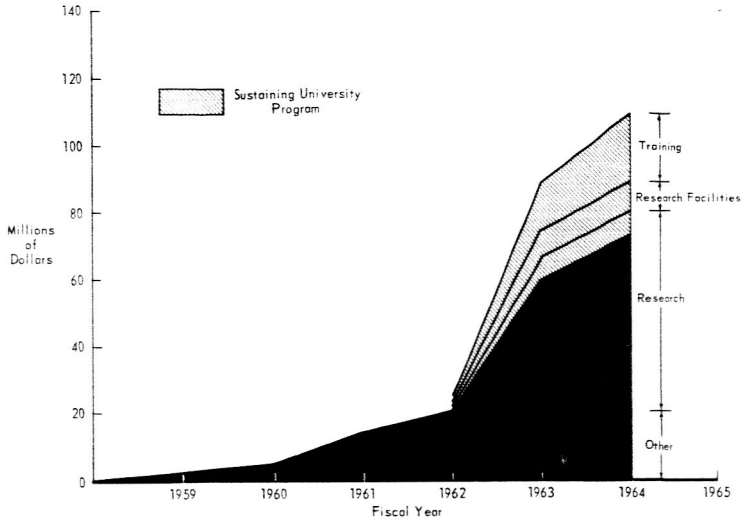

FIGURE 4—NASA obligations to universities.

Table I, which shows a categorization of NASA's Fiscal Year 1964 obligations to universities, may provide further insight into the nature and scope of NASA's activities in the universities. In Fiscal Year 1964 research support amounted to just under $50 million, of which a little over $7 million was used for the specialized support of research under the Sustaining University Program. Thus a little over $42 million went for the support of project-type research.

Although "Satellite Instruments," the next category in table I, are integral parts of the scientific experiments, funds for them are listed separately because the rigorous environment to which

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TABLE I.—NASA FY 1964 Obligations to Universities

	HEADQUARTERS	CENTERS	TOTAL NASA
Research support	$38 450 353	$10 776 230	$49 226 583
	*(7 156 489)		*(7 156 489)
Satellite instrumentation	1 086 934	9 358 822	10 445 756
Tracking and data acquisition		1 967 525	1 967 525
Research facilities	*9 142 760		9 142 760
Training in space science and technology	*19 815 471		*19 815 471
NASA career employee training	55 000	1 520 000	1 575 000
Apollo guidance		16 286 000	16 286 000
Miscellaneous	304 382	147 176	451 558
TOTAL	68 854 900	40 055 753	108 910 653
	*(36 114 720)		*(36 114 720)

*Sustaining University Program.

they are subjected, including the necessity to withstand the forces and vibration of rocket launching and still be able to operate satisfactorily in gravity-free space, makes their construction and testing an extremely complex and difficult task. The design and fabrication of suitable instrumentation is often beyond the technological capability of a university. Yet it is essential that the scientist be intimately involved in the development of his instrumentation and so this phase of the work is contracted with the university; however, in many instances, it is, in turn, subcontracted by the university to specialized industries.

The next item "Tracking and Data Acquisi-

tion" represents in large measure a service type of activity provided by a few universities in the operation of tracking stations and in data acquisition and reduction in the support of range activities.

The item "Research Facilities" represents the funds made available through the Sustaining University Program for the construction of research laboratory space on university campuses.

The item "Training in Space Science and Technology" represents the activities carried on as a part of the Sustaining University Program, principally for graduate study.

The item entitled "NASA Career Employee Training" represents the university program entered into by NASA to provide for continued professional development of the NASA staff. This program involves, in large measure, working agreements that are established directly between the universities and the NASA Centers.

"Apollo Guidance" has been listed separately because of the size of the effort and because it is to a large degree a unique university activity. Conducted in the Instrumentation Laboratory at M.I.T., it represents a follow-on by this group of an endeavor for the space program that is similar to their highly successful development of the Polaris guidance system.

The item "Miscellaneous" includes those funds that find their way into universities that could not readily be associated with the previous categories.

Although the primary concern here is with

programmatic activities rather than business arrangements that are entered into to support the various programmatic studies, there are two basic features of NASA policy with respect to its dealings with educational institutions that deserve mention. First, in the development and conduct of the NASA University program, the one basic principle underlying all NASA policy regarding its relationships with universities is that NASA wishes to work within the structure of the universities in a manner that will strengthen the universities and at the same time make it possible for NASA to accomplish its mission. While we are anxious to reap the benefits to be gained by developing research potential in the universities, we want to support research in the traditional atmosphere of instruction and learning from research that results from keeping the research activities surrounded by students. We are keenly aware of the need for an ever-increasing supply of highly trained personnel if we in NASA, and in fact the Nation as a whole, are to carry out our goals successfully and reap the maximum benefits of the Nation's space program. We are not interested in the creation of institutes that tend to draw university faculty away from the educational aspects of their research. The university is the only segment of the team undertaking this space program that produces manpower. The other two partners in this enterprise—industry and government—only consume manpower. It is for this reason that NASA hopes to conduct its

joint activities in a manner that will preserve and strengthen the universities' educational role. This basic policy is interwoven in the policies and procedures of NASA's support of training, research, and research facilities.

The other basic policy is that of striving, wherever possible, to assure the long term funding that is so essential to the successful conduct of research. We have pioneered, within NASA, the use of a funding mechanism which has become known as either step funding or forward funding in a manner that is intended to give stability to those university programs that are known to be of several years' duration. The pattern of this type of funding is shown in figure 5. Under this arrangement funds in the amount of 100 percent of the agreed level of effort are made available during the first year.

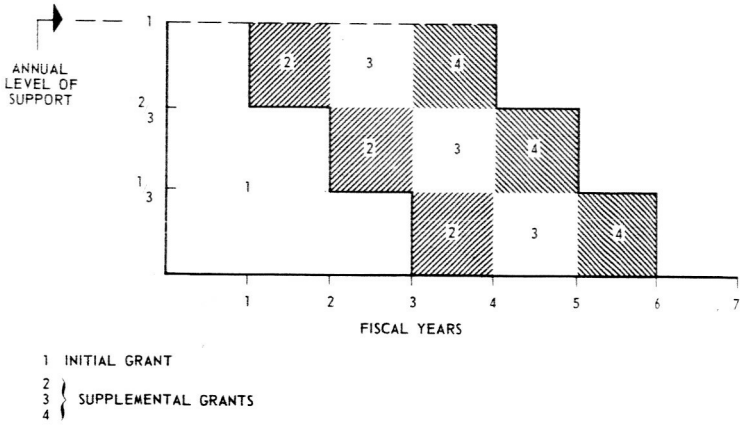

FIGURE 5—Step funding of research support.

Funds in the amount of two-thirds of the agreed level of effort are programed to be paid during the second year and one-third of the agreed level of effort would be paid during the third year. When the initial grant is made, these funds are all set aside by NASA and are paid to the university on demand from the university on a quarterly basis. During the course of the investigation, based upon a semiannual review, NASA will supplement the grant annually with a grant of funds in the amount of the agreed-upon level of effort. These supplements are scheduled to be paid in accordance with the university's demand over a 3-year period, as indicated in the figure. In this manner, the university always has funds coming in for 2 additional years, at a reduced rate, should NASA decide to withdraw its support or Congress fail to appropriate funds for this purpose. This permits the university to dissipate any obligations which it may have incurred in an orderly manner over a 2-year period. Although this type of funding is not appropriate for all research, it is desirable for the greater part of research activities that NASA supports because it creates stability and thereby increases research productivity. Every effort is made, when appropriate, to use this funding technique.

During Fiscal Year 1964, something in excess of $42 million was obligated to universities for the support of project-type research. This research is that which is either an integral part of or in direct support of rather specific require-

ments of on-going NASA programs. As a mission-oriented agency, the NASA organization has been arranged in such a manner as to support most effectively the conduct of its mission. "Mission oriented" should not be interpreted to mean "limited to putting a man on the Moon." In fact, the first objective of NASA, as stated in its enabling legislation, the National Aeronautics and Space Act of 1958, is: "(1) The expansion of human knowledge of phenomena in the atmosphere and space. . . ." This certainly covers a broad spectrum of activity from research of a very basic nature to the most sophisticated type of applied research and development.

One very important, interesting, and at the same time very complex type of project research is that associated with the NASA space flight program. Experiments conducted in space, as noted previously, require the application of very sophisticated technology and also involve a long lead time which make it difficult to integrate them into a university's normal academic program. However, they represent our attack on the most fundamental and important problems confronting our understanding of the basic nature of space. The participation of the university is essential if we are to reap the greatest gains possible in this program. Many university scientists have had experiments flown on the various tools employed for space research—airplanes, balloons, sounding rockets, satellites, and deep space probes. There are

extensive opportunities in this type of participation. (See ref. 1.)

NASA has three principal program offices. The mission of the Office of Space Science and Applications is largely that of determining what the space environment is comprised of and what use can be made of it. The meteorological satellites and the communication satellites are examples of applications. Careful inspection of its activities will disclose that it is responsible for the unmanned space flight program as well as the scientific activities of the manned space flight program.

The Office of Advanced Research and Technology is intended to serve as the bridge that brings new ideas and concepts arising out of basic research activities to the point where they may be incorporated into operating components or systems that can be employed in either unmanned or manned space flight programs. As the title of the office implies, OART is responsible for updating technology. As such it has a broad range of interest in the whole spectrum of applied research activities, ranging from life support systems to new and improved methods of propulsion.

The Office of Manned Space Flight is largely operational in nature, being charged with carrying on the manned flight programs. The outstanding success of the Mercury program is well known. NASA is now vigorously pursuing the Gemini program and the Apollo program. Because of the operational character of the manned flight pro-

gram, the opportunities for direct university participation are not so extensive as with the Office of Space Science and Applications and the Office of Advanced Research and Technology. Nevertheless, there are important activities, the principal ones being in the medical field.

Because of its mission-oriented nature, there is a problem as to how the academic community can communicate with NASA. For example, NASA has no Chemistry Division yet it has a wide interest not only in fundamental research in many of the areas of chemistry, but also in the activities of the chemical engineering departments. This lack of a one-to-one correlation between NASA's organizational structure and that prevalent in the universities is one of the reasons that NASA established the Office of Grants and Research Contracts. It is intended that through this office it will be possible for the university man to locate those counterparts of the NASA organization with whom he may have a community interest. Further, this Office is responsible for coordinating these activities to insure a coherent and well integrated program. It is for these reasons that the Office of Grants and Research Contracts has been given the responsibility to receive, catalog, and insure the proper handling of all proposals submitted to NASA by nonprofit scientific and educational institutions and all unsolicited proposals from other sources.

To insure that appropriate consideration is

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given to a proposal, all proposals when formally submitted should be directed to the Office of Grants and Research Contracts. If discussions have been held with someone within the NASA organization, this should be mentioned in the letter of transmittal and a copy of the proposal should be sent to him. Failure to submit proposals to the Office of Grants and Research Contracts in this manner will more often than not delay appropriate action rather than accelerate it.

Although NASA requests that all formal proposals be submitted through the Office of Grants and Research Contracts, it encourages direct communication between the university personnel and scientists within the NASA organization for the exchange of information on problems of mutual interest. During the early days of NASA its organization was in a considerable state of flux and often rapid changes in personnel or, in some instances, the disappearance of organizational entities or the addition of new ones made this type of communication very difficult, if not impossible. Fortunately, this situation is considerably improved although it may be expected that any active dynamic program, such as the space program, will be subject to some changes.

Those organizational entities within the three NASA program offices in which there should be considerable interest on the part of the members of the academic community are shown in figures 6 to 8. These groups support the project-type

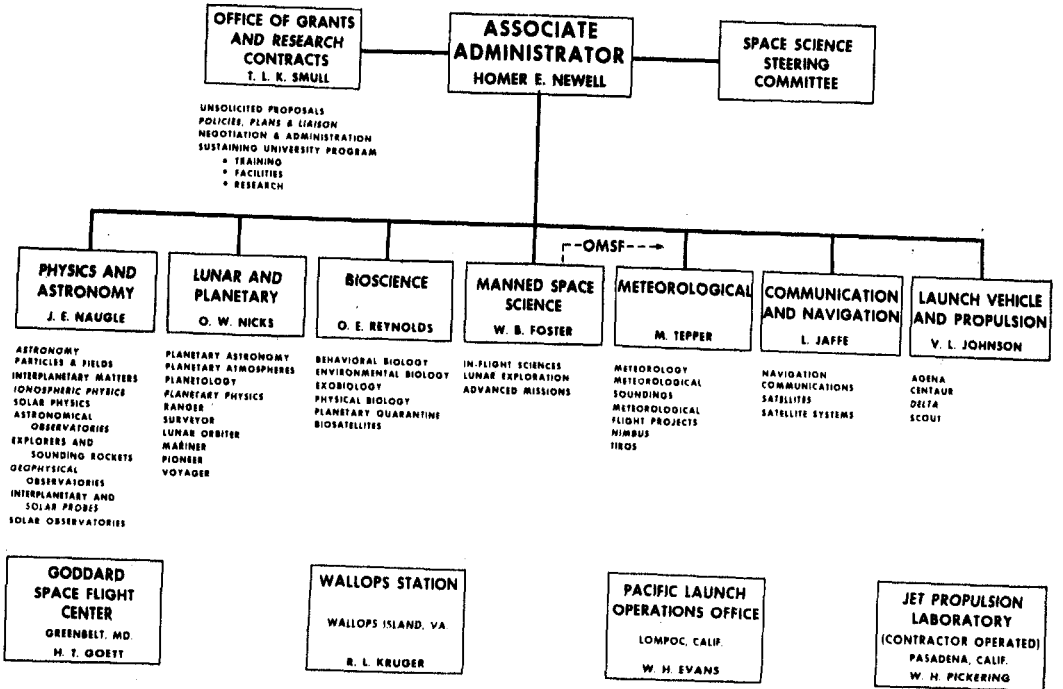


FIGURE 6—Partial organization of the Office of Space Science and Applications.

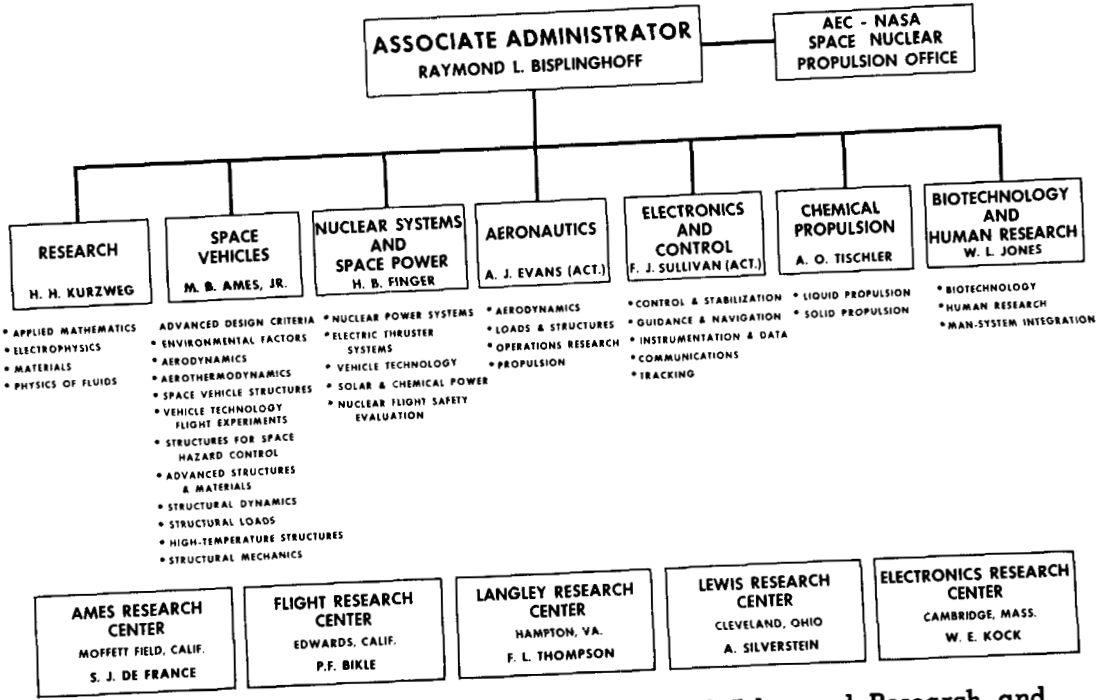


FIGURE 7—Partial organization of the Office of Advanced Research and Technology.

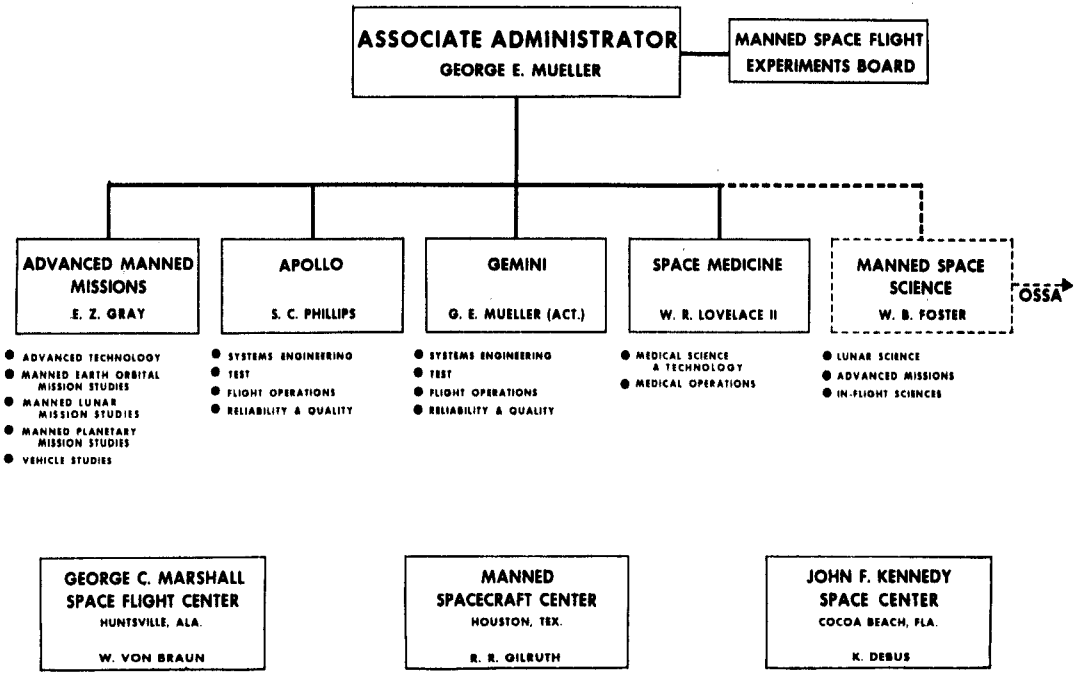


FIGURE 8—Partial organization of the Office of Manned Space Flight.

research activities that NASA sponsors. Figure 9 shows the organization of the Office of Grants and Research Contracts. It is arranged to handle not only the program and coordination function but also the business arrangements with the universities. No matter what the source of funding, all grants made by NASA are issued by the Office of Grants and Research Contracts, as are all contracts that emanate from NASA Headquarters.

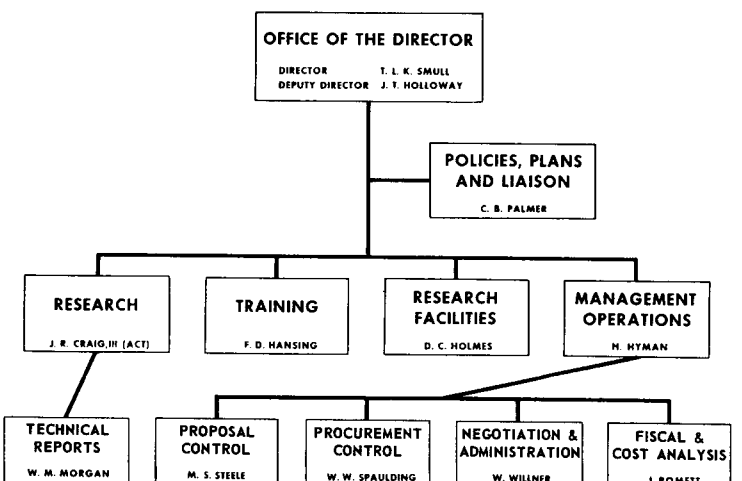


FIGURE 9—Organization of the Office of Grants and Research Contracts.

In addition to the normal flow of information in the form of technical reports, Congressional reports on consideration of NASA legislation and appropriations, technical meetings, speeches, press

releases, and visits, we have recently added regular issuance of a series called Research Suggestions (ref. 2) to aid the exchange of information between NASA and the scientific community. These Research Suggestions, which are issued by the Office of Grants and Research Contracts, present discussions of areas of research in which NASA is interested or problems the solution of which would be helpful to the space program. The material contained in these issuances should be helpful in indicating desirable topics for basic research as well as stimulating ideas that may culminate in sponsored research projects.

As previously noted, in 1961, when the space program was considerably stepped up as a result of the decision to place an American on the Moon in this decade, NASA took stock of its university activities with the assistance of a group of university people. Out of these studies came the ideas and recommendations that resulted in the establishment of the Sustaining University Program. It was readily evident that additional steps should be undertaken by NASA to expand and improve the partnership between NASA and the universities if the national goals in space were to be rapidly and efficiently achieved. The Sustaining University Program was established with these goals:

An increase in the production rate of highly trained people

More adequate laboratory facilities in which to conduct research in support of the NASA mission

Removal of the interdisciplinary barriers in research and fostering of genuine cooperation between workers in collateral fields

An increased awareness by universities of their national responsibilities in the attainment of national goals

Application by universities of their unique and extensive talents to an understanding of the interrelationship of space research and technology, academic processes, industry, commerce, and society in general

At the outset, it was recognized that one of the critical aspects of the space program was the need to assure a supply of highly trained scientists and engineers that would be required to carry out the space program effectively and efficiently. NASA felt a strong responsibility to stimulate the training of the requisite personnel and hoped to achieve this by undertaking a program of training grants. Under these grants funds were made available for stipends to predoctoral students to be chosen by the universities participating in the program; in addition, funds in the form of an institutional allowance to enhance graduate study in space science and technology at the universities were included. The program thus was not only designed to accelerate the production of Ph. D.'s in science and technology, but was also structured in a manner to strengthen the universities' graduate capabilities.

It was NASA's belief that by making funds available that would permit a student to pursue his graduate studies on a full-time basis the time required to achieve the Ph. D. would be shortened

and thus the number of Ph. D.'s produced annually would be increased. Although these graduate fellowships could be held by a student for 3 years if his progress were satisfactory, we had no preconceived notion that the doctoral degree could, or necessarily should, be attained in a 3-year period but rather that it would be appropriate for NASA to support a student for that period of his graduate studies.

NASA undertook as a goal the production of 1000 Ph.D.'s annually. To accomplish this it was estimated that by supporting approximately 1350 students for 3 years it might be expected that 1000 would achieve their degrees. If 1350 were started annually, this would be a steady-state program of 4000 in training at any given time, with perhaps 1000 receiving their doctoral degrees each year.

This program was initiated in Fiscal Year 1962, with grants to 10 universities to cover the training of 10 students at each institution. In Fiscal Year 1963, 786 traineeships were established with 88 universities participating. In Fiscal Year 1964 there were 1071 new starts at 131 institutions. Fiscal Year 1965 grants have been made to 142 institutions to support the graduate study of 1275 more students, beginning September 1965. The growth of this program is shown in figure 10.

In making these grants NASA stated that they should be made available to the best students

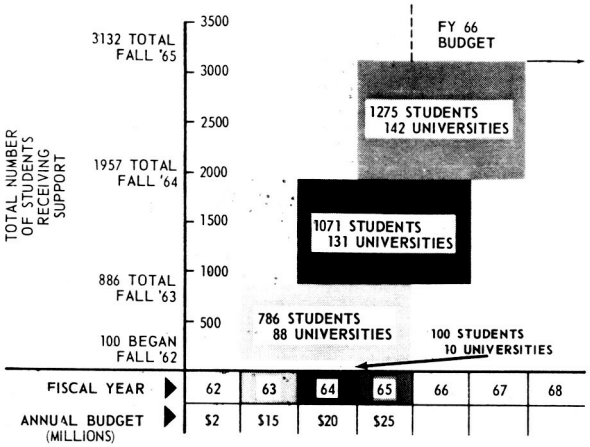


FIGURE 10—History of NASA predoctoral training program.

without consideration of discipline except that it must be one that was space related and in a field for which the university had an approved doctoral program. In other words, we made no attempt to bias the distribution of the traineeships. This natural selection procedure has produced a distribution of students by fields, as shown in table II, that we feel is very satisfactory. The aggregate 3-year distribution is shown pictorially in figure 11.

In the fall of 1965 there will be 3132 students studying for their doctoral degrees under this program in 142 universities located throughout the 50 states. The geographic distribution of these students is shown in figure 12.

In addition to this program there are several other small training programs that comprise the

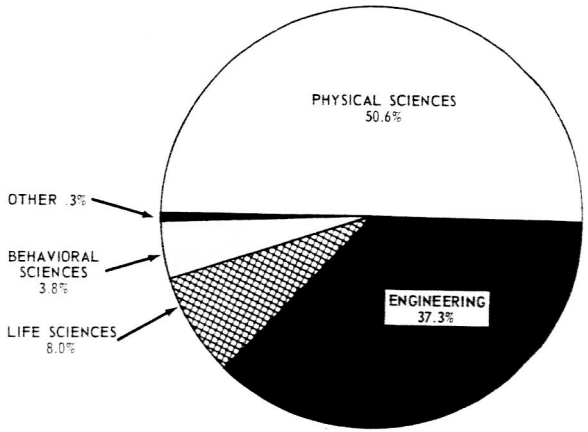


FIGURE 11—Aggregate distribution of students by general field (1962, 1963, 1964).

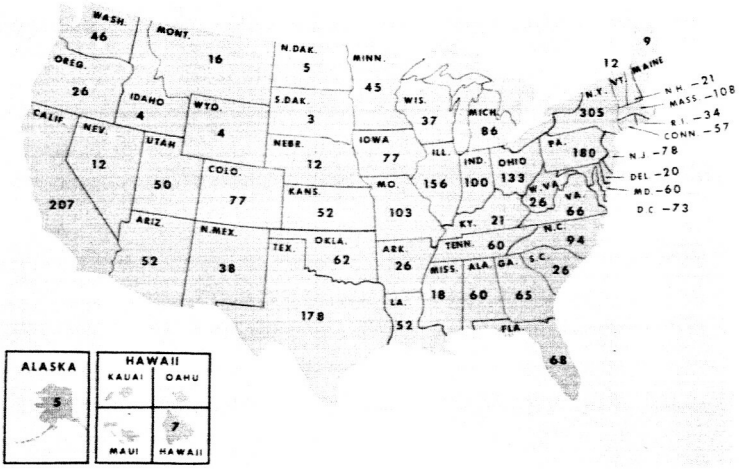


FIGURE 12—NASA predoctoral students (3132) in training, school year 1965–66.

TABLE II.—Distribution of the 1957 NASA Trainees

	1962	1963	1964
PHYSICAL SCIENCES			
Mathematics	6	58	118
Chemistry	14	95	152
Physics	31	173	212
Astronomy	4	18	27
Geology & Geophysics	2	28	35
Atmospheric Sciences	1	4	12
Computer Science	1	0	1
Subtotal	59	376	557
Percentage	59.0	47.8	52.0
ENGINEERING			
Electrical & Instruments	6	95	108
Mechanical	9	60	70
Chemical	5	49	59
Aeronautics/Astronautics	6	43	51
Civil	0	15	18
Engineering Mechanics	1	25	18
Metallurgical & Materials	2	18	21
Engineering & Applied Science	0	9	12
Nuclear	3	8	9
Industrial	0	4	7
Subtotal	32	326	373
Percentage	32.0	41.5	34.8
LIFE SCIENCES			
Zoological Sciences	2	30	43
Botanical Sciences	0	12	20
Biochemistry & Biophysics	3	9	16
Microbiology	0	5	9
Genetics	0	5	3
Subtotal	5	61	91
Percentage	5.0	7.8	8.5

BEHAVIORAL SCIENCES			
Psychology	3	16	29
Economics	0	3	7
Political Science	0	4	7
Anthropology	0	0	1
Subtotal	3	23	44
Percentage	3.0	2.9	4.1
OTHER			
Business Administration	0	0	4
Industrial Management	0	0	1
Philosophy of Science	0	0	1
Space Law	1	0	0
Subtotal	1	0	6
Percentage	1.0	0	0.6
TOTAL	100	786	1071

AGGREGATE 3-YEAR TOTALS

	No.	%
Physical Sciences	992	50.6
Engineering	731	37.3
Life Sciences	157	8.0
Behavioral Sciences	70	3.8
Other	7	.3
	1957	100.0

training segment of the Sustaining University Program. Although comparatively small in terms of cost, we feel that they are of considerable significance. Table III shows the total activity under the training portion of the Sustaining University Program.

TABLE III.—NASA Training Program FY 1965

- PREDOCTORAL TRAINING

Grants made to 142 institutions to support 1275 new students for 3 years beginning September 1965.

- SUMMER FACULTY FELLOWSHIPS

Joint Programs between NASA Centers and Universities. Eight- or ten-week seminars, with research in space science and engineering.

INSTITUTION	NASA CENTER	PARTICIPANTS
Auburn/Alabama U.	Marshall SFC.	15
Case Inst. of Tech.	Lewis RC.	25
Columbia University.	Goddard-ISS.	12
Houston/Texas A & M.	MSC.	15
Maryland/Catholic U.	GSFC.	15
Stanford University.	Ames RC.	27
Virginia Associated RC.	Langley RC.	23

- SUMMER INSTITUTES IN SPACE SCIENCE AND TECHNOLOGY

Six-week courses for nationally selected, gifted undergraduates.

Columbia University.	Goddard-ISS.	60
UCLA.	JPL.	45
University of Miami.	Kennedy SC.	30

- POST-M.D. TRAINING IN AEROSPACE MEDICINE

Specialized medical training concerned with environmental problems of man-in-space.

Harvard University. 3

- SUMMER PROGRAM ON RELATIVITY THEORY AND ASTROPHYSICS

Joint Support with NSF, AEC, AFOSR, ARO, and ONR. Four-week seminar on general theory of relativity and recent experiments designed to test the theory.

American Mathematical Society. 100

The Summer Faculty Fellowships are in essence a group of institutes sponsored jointly by NASA and the universities in the immediate vicinity of seven of our Centers. They offer the opportunity for approximately 125 faculty members to get first-hand research experience with space problems by spending some time in one of the Centers and concurrently participating in seminar-type activity conducted by the university or universities on some space-related topic.

A second small program which we feel has been highly successful is the Summer Institute which offers the opportunity for interested undergraduates chosen on a national basis to participate in an intensive exploratory program in space science or in space technology.

Two other NASA training programs currently underway are of general interest. NASA's International Fellowship Program, which involves 50 students, provides stipends for foreign nationals who are sponsored by their country for graduate and postdoctoral study in the space sciences at a number of American universities. The other program involves postdoctoral studies at NASA Centers and is called the Resident Research Associateship Program. Seventy associateships have been established for Fiscal Year 1965 for study at any of six NASA installations. Both of these programs are administered for NASA by the National Academy of Sciences.

The second segment of the Sustaining Univer-

sity Program is concerned with support, at qualified universities, of research that is somewhat different from that which we commonly term project research. The purposes for which these grants have been made are threefold. First, they have been used in the support of broad multidisciplinary investigations. A second important use has been for the support of research, generally in some coherent area of science or technology, to establish new groups where latent competence is apparent and there is an earnest and potentially fruitful research activity that is of interest to the space program. Grants of this nature are not large in monetary value and are aimed at overcoming one of the barriers, real or fictitious, known in the research support business as the inability to get a grant because one has never had a grant. Through this type of grant it is hoped to broaden the research base and bring selected new groups up to the level where they may compete directly for support.

The third type of use of funds made available for these special purpose grants is for grants to tie together or coordinate related projects in coherent areas of investigation. In some cases adequate support lies beyond the scope of a single project although this effort, if encouraged, would materially increase the productivity of the whole complex. Likewise, this type of research grant may serve as a base for several projects whose support fluctuates in time to lessen the impact of such fluctuations upon the university structure.

These special purpose research grants are now in effect in some 30 universities throughout the country. Each grant has been tailored to the specific situation existing at the institution and while they may generally be motivated by any one of the three reasons mentioned previously, they all offer the opportunity for multidisciplinary studies within the institution and, accordingly, they are generally classified as multidisciplinary research grants. Figure 13 shows the location of the grants now in existence. We feel that support of research in this manner is a most effective way of permitting the universities to give full play to their competence

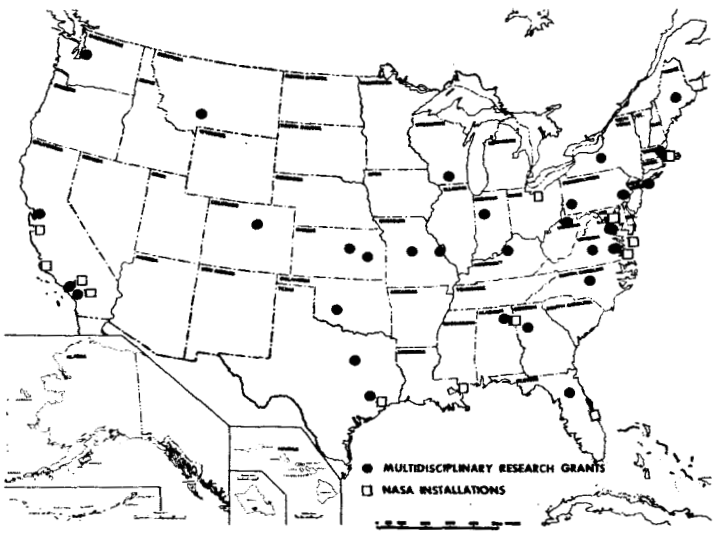


FIGURE 13—SUP multidisciplinary research grants.

and ability to make their requisite contribution to the space program.

The third segment of the Sustaining University Program is concerned with research facilities grants to provide reasonably adequate working space for the universities engaged in the space program. The need for research laboratory space in universities is readily evident and it obviously will not be possible for many universities to undertake the work of which they are capable and which is necessary if national goals in space are to be realized unless laboratory facilities are made available. It is through the research facilities grants program that NASA hopes to carry out its responsibilities in this regard.

To date NASA has made 27 research facilities grants to nonprofit scientific and educational institutions for the construction of additional facilities urgently needed. In general, these grants have been made to educational institutions that have become active in research and have begun to make substantial contributions to the space program; by so doing they have outgrown the facilities available to them to carry on their investigations adequately. It is through this program that NASA attempts to relieve the critical shortage of facilities for groups now doing important research pertinent to the NASA mission.

The grants that have been made as of March 1, 1965, from the inception of this program in

Fiscal Year 1962, are shown in table IV. These grants have been for dollar amounts, determined by NASA to be appropriate in each instance, up to the full cost of the proposed building and have been made for the acquisition of research laboratory space. In each of these grants the Administrator of the National Aeronautics and Space Administration has determined that the Nation's interests would best be served by investing title in the grantee.

Figure 14 shows the location of these facilities. Figure 15 shows seven facilities that are nearing completion. In fact, six of them have reached the stage that they are either partially or totally occupied.

TABLE IV.—Summary of Research Facilities. March 1, 1965

INSTITUTION	INVESTIGATOR/TOPIC	AREA, gross sq ft	AMOUNT, dollars
	FISCAL YEAR 1962		
RPI	Wiberley/Materials Research.	59 800	1 500 000
Stanford	Lederberg/Exobiology	14 500	535 000
Chicago	Simpson/Space Sciences	45 000	1 775 000
Iowa	Van Allen/Physics & Astron	24 000	610 000
California (Berkeley).	Silver/Space Sciences	44 100	1 990 000
Harvard	Sweet/Biomedicine	4 500	182 685

TABLE IV.—Continued

INSTITUTION	INVESTIGATOR/TOPIC	AREA, gross sq ft	AMOUNT, dollars
	FISCAL YEAR 1963		
Minnesota	Nier/Physics	17 400	704 000
M.I.T.	Harrington/Space Sciences	75 000	3 000 000
Colorado	Rense/Astrophysics	31 800	792 000
UCLA	Libby/Space Sciences	68 500	2 000 000
Wisconsin	Hirschfelder/Theor. Chem	12 000	442 760
Michigan	Norman/Space Sciences	56 000	1 750 000
Pittsburgh	Halliday/Space Sciences	47 300	1 500 000
Princeton	Layton/Propulsion Sciences	26 300	625 000
Lowell Observ.	Hall/Planetary Sciences	8 600	236 520
	FISCAL YEAR 1964		
Texas A & M	Wainerdi/Space Sciences	34 000	1 000 000
Maryland	Martin/Space Sciences	70 000	1 500 000
USC	Meehan/Human Centrifuge	4 000	160 000
Cornell	Gold/Space Sciences	38 000	1 350 000
Rice	Dessler/Space Sciences	68 000	1 600 000
Purdue	Zucrow/Propulsion Sciences	5 000	840 000
Washington (St. Louis).	Norberg/Space Sciences	24 600	600 000
New York	Ferri/Aeronautics	21 000	582 000
Georgia Tech	Picha/Space Sciences & Technology.	50 000	1 000 000
Arizona	Kuiper/Space Sciences	50 000	1 200 000
Illinois	Alpert/Space Sciences	51 000	1 125 000
PIB	Bloom/Aerospace Sciences	16 000	632 000
TOTAL		966 400	29 231 965

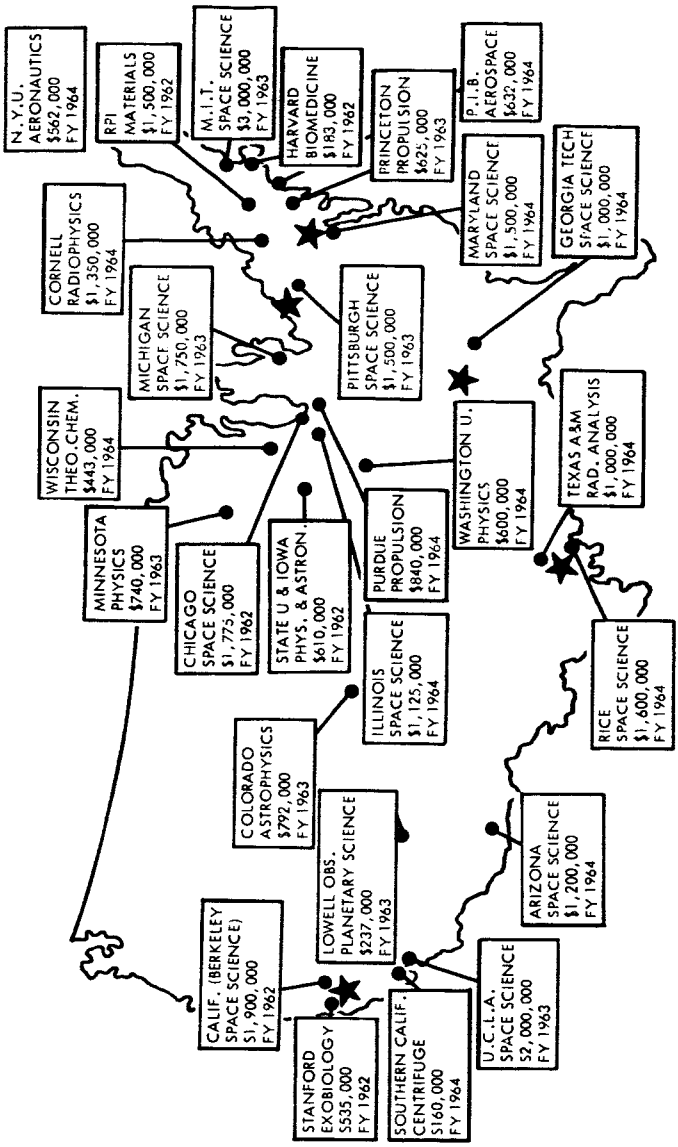
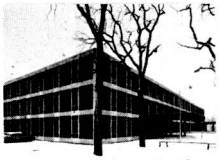


FIGURE 14—Sustaining University Program research facilities.

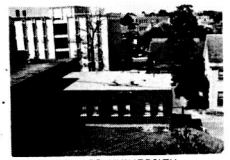
PRINCETON UNIVERSITY
PROPULSION LABORATORIES

UNIVERSITY OF MINNESOTA
PHYSICS RESEARCH LABS

LOWELL OBSERVATORY
PLANETARY RESEARCH CENTER

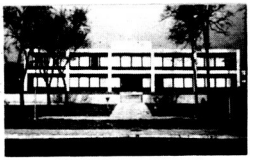


RENSSELAER POLYTECHNIC
INSTITUTE
MATERIALS RESEARCH
CENTER



HARVARD UNIVERSITY
BIO-MEDICAL ANNEX

UNIVERSITY OF PITTSBURGH
SPACE SCIENCES & COORDINATION CENTER



UNIVERSITY OF CHICAGO
SPACE SCIENCES LABORATORY

FIGURE 15—Completed research facilities.

One important consideration in the making of a research facilities grant is an agreement which culminates in the signing of a Memorandum of Understanding between NASA and the institution in question by the Administrator of NASA and the principal executive officer of the institution, which states in part:

It is the policy of the National Aeronautics and Space Administration to support research in space-related science and technology at nonprofit scientific and educational institutions. Where additional research facilities are urgently needed to conduct such research in support of the national space effort, and the institution involved has demon-

strated its intent to seek ways in which the benefits of this research can also be applied to the social, business, and economic structure of the United States, NASA may supplement research support with funds necessary for the construction of such facilities. The National Aeronautics and Space Administration is particularly desirous that the environment in which space research is conducted and its full benefits realized will be characterized by a multidisciplinary effort which draws upon creative minds from various branches of the sciences, technology, commerce, and the arts. The desires of the university are in conformity with this policy, and the institution tends to foster and conduct research in all areas of space-related sciences, bring to bear on this research the efforts characteristic of a major university, and seek ways in which both the direct and indirect benefits of such research can contribute to the economic, social, and general well-being of the nation.

Of special significance is a portion of the last sentence which states that the university will ". . . seek ways in which both the direct and indirect benefits of such research can contribute to the economic, social, and general well-being of the nation." Implicit in this statement is our expectation that the university will go beyond the more conventional role of teaching, seeking new knowledge, and serving as the custodian of knowledge by seeking new ways to accelerate the flow of this knowledge to and its potential uses by the community.

Discussion of this portion of the Memorandum of Understanding touches on merely one aspect of the whole subject of technology utilization. In

such a large scientific and technological endeavor as the space program NASA would be delinquent in its responsibilities if it did not make a concerted effort to see that the knowledge brought about by this program serves not only the interests of the program itself but is usefully applied in improving national welfare. To this end, NASA several years ago established its Office of Technology Utilization. The program of this office involves NASA, the universities, industry, and the community. There is a very important role for the universities and they are playing an ever-increasing role seeking ways to speed the flux of recently acquired scientific and technological information into our civilian economy.

The Sustaining University Program has been designed as an integrated program encompassing the support of training, research, and research facilities in a manner that will augment and complement sponsored project research and in-house activity in support of NASA's mission. We consider it essential to develop a strong, mutually interdependent relationship between NASA and the universities in working to fulfill the needs for scientific manpower and research in the Nation's space program. It is our belief that within the universities rests the competence, imagination, leadership, and integrity that are essential for the conduct of these activities of mutual interest. As long as the universities demonstrate that they are able to carry on these activities in a creative and responsible

manner, NASA will strive to maintain the broad liberal approach that we believe is self-evident in the NASA University program.

REFERENCES

1. Opportunities for Participation in Space Flight Investigations. Office of Space Science and Applications, NASA, Jan. 1965.
2. NASA Management Manual Instruction 7140.1. Administrative Services (Code BAM–1), NASA.

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